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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,185	02/09/2004	Kia Silverbrook	MTB27US	8427

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EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

DATE MAILED: 08/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,185	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/21/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 4, 17, 22, 36, and 53 is withdrawn in view of the newly discovered reference(s) to Lee et al. (US 6460961 B2) and DeMoor et al. Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6, 8, 10, 11, 13, 14, 17, 19-25, 27, 29, 30, 32, 33, 36, 38-44, 46, 47, 49, 50, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2), and Lee et al. (US 6460961 B2).

Silverbrook teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 5, lines 34-38*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*elements 41, Figure 3*);

a bubble forming chamber corresponding to each of the nozzles (*element 112, Figure 9*);

at least one heater element disposed in each of the bubble forming chambers

respectively (*element 120, Figure 12*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*), such that,

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); wherein,

the heater element is an elongated strip (*element 441, Figure 13*), and

the heater element has a serpentine form (*Fig. 13*) that extends between two adjacent electrodes (*electrodes 442, Fig. 13*) spaced from each other by a gap (*gap between electrodes 442 of Fig. 13*)

***further regarding claim 38**, supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (*col. 12, lines 59-61*); and

forming the gas bubble (*bubble 116*) on an axis (*axis R, see Drawing A below*) which extends through the center of the nozzle (*Drawing A*)

***regarding claims 2 and 20**, the gas bubble (*bubble 116*) is formed on an axis (*axis R, see Drawing A below*) which extends through the center of the nozzle (*Drawing A*)

***regarding claims 3 and 21**, the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*)

***regarding claims 5, 24, and 42**, the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 9, lines 26-30*)

***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and to be a page-width printhead (*col. 2, lines 19-22*)

***regarding claims 8, 27, and 44**, each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that

heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29, and 46**, a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm:* $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$)

***regarding claims 11, 30, and 47**, each heater element has two opposite sides (*sections of heater element 120 on the left and right sides of the chamber 488, Figure 18*) and is configured such that a gas bubble formed by that heater element is formed at both of the sides of that heater element (*bubble 116 formed on both sides, Figure 18*)

***regarding claims 13, 32, and 50**, a structure that is formed by chemical vapor deposition, the nozzles being incorporated on the structure (*col. 5, lines 47-49*)

***regarding claims 14, 33, and 49**, a structure that is less than 10 microns thick, the nozzles being incorporated on the structure (*col. 9, lines 8-10*)

***regarding claim 23**, support the bubble forming liquid in thermal contact with each heater element (*col. 17, lines 37-43*), and to support the ejectable liquid adjacent each nozzle (*col. 17, lines 37-40*)

***regarding claim 39**, the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*)

***regarding claim 40**, the heater element extends between the electrodes mounted on opposite sides of the bubble forming chamber (*heater element 121 extending between unreferenced electrodes on opposite sides of chamber, Figure 58b*)

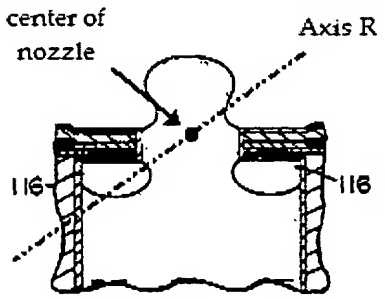
Silverbrook does not expressly teach:

***regarding claims 1, 19, and 38**, the heater element is suspended, the strip having a cross section with a lateral dimension at least triple that of the thickness of the strip; and

the heater element has a second gap diametrically opposed to the gap between the electrodes

***regarding claims 4 and 22**, the serpentine form is a double omega shape wherein a first omega shape extends between the electrodes, and a second omega shape is inverted relative to the first and extends between the second gap which is in the first omega shape

***regarding claim 41**, the heater element is less than 0.3 microns thick and more than 1 micron wide



Drawing A: Figure 27 from Silverbrook '457, edited for clarification

Gerber et al. teach the following:

***regarding claims 1, 19, and 38**, the heater element is suspended (*col. 4, lines 31-32*)

Hiramatsu et al. teach the following:

***regarding claims 1, 19, and 38**, the heater element has a cross section with a lateral dimension at least triple that of the thickness of the strip (*aspect ratio of 10-5000, lines 46-48*)

***regarding claim 41**, the heater element is less than 0.3 microns thick and more than 1 micron wide (*the width may be 0.1 mm, col. 15, lines 33-35; using the disclosed aspect ratio of 5000 from col. 15, lines 46-48, the thickness would be 0.02 microns*)

Lee et al. teach the following:

***regarding claims 1, 19, and 38**, the heater element (single heating element 120'') has a second gap (gap that is adjacent electrodes 130 of Fig. 5) diametrically opposed to the gap between the electrodes (gap between electrodes 160 of Fig. 5)

***regarding claims 4 and 22**, the serpentine form is a double omega shape (Fig. 5) wherein a first omega shape (outer annulus of heating element 120'', Fig. 5) extends between the electrodes (Fig. 5), and a second omega shape (inner annulus of heating element 120'', Fig. 5) is inverted relative to the first (Fig. 5) and extends between the second gap which is in the first omega shape (Fig. 5)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a suspended heater resistor (Gerber et al.), to utilize a resistor strip with a cross section with a lateral dimension at least triple that of the thickness (Hiramatsu et al.), and to utilize a heater resistor with a second gap diametrically opposed to a gap between electrodes (Lee et al.) into Silverbrook's invention. The motivation for doing so, as taught by Gerber et al., is so that the resistor will quickly increase in temperature since the heat is not absorbed by the substrate (*col. 4, lines 32-38*). The motivation for doing so, as taught by Hiramatsu et al., is to increase the resistance value of the heating elements and keep the evenness of the temperature

on the heating face (*col. 15, lines 49-52*). The motivation for doing so, as taught by Lee et al., is to provide a heater arrangement adapted to produce gray scale printing more quickly and easily (col. 1, lines 50-53).

Claims 7 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2) and Lee et al. (US 6460961 B2), as applied to claims 1, 19, and 38 above, and further in view of Lebens et al. (US 6631979 B2).

Silverbrook, Gerber et al., Hiramatsu et al., and Lee et al. teach all claimed limitations except for the following:

***regarding claims 7 and 26,** the heater element is in the form of a cantilever beam

Lebens et al. teach the following:

***regarding claims 7 and 26,** the heater element is in the form of a cantilever beam (*col. 3, lines 8-17*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a cantilevered heater element into the invention of Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. The motivation for doing so, as taught by Lebens, is so that the heater element can be operated at reduced energy (*col. 2, lines 57-61*).

Claims 9, 28, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2), and Lee et al. (US 6460961 B2), as applied to claims 1, 19, and 38 above, and further in view of Otsuka et al. (US 5485179).

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. teach all claimed limitations except for the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point

Otsuka et al. teach the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (*col. 13, lines 21-28 shows that the energy required to heat the heater is less when the ambient temperature is high, and more when the ambient temperature is low; therefore, Otsuka teaches that it would take less energy to eject a drop of ink than it would to heat ink from an ambient temperature to a boiling temperature*).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Otsukia's heating configuration into the invention of Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. The motivation for doing so, as taught by Otsuka, is to control the temperature of the recording head based on the present ambient temperature (*col. 12, lines 41-49*)..

Claims 12, 31, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Gerber et al. (US 6680668 B2), Hiramatsu et al. (US

6967312 B2), and Lee et al. (US 6460961 B2), as applied to claims 1, 19, and 38 above, and further in view of Campbell et al. (US 4870433).

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. teach all claimed limitations except for the following:

***regarding claims 12, 31, and 48,** the bubble, which each element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element

Campbell et al. teach the following:

***regarding claims 12, 31, and 48,** the bubble that each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (*col. 3, lines 60-64*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the heater element design of Campbell to modify the invention of Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. The motivation for doing so, as taught by Campbell et al., is to prevent cavitational damage to the heater elements (*col. 3, lines 14-23*).

Claims 15, 16, 18, 34, 35, 37, 51, 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2), and Lee et al. (US 6460961 B2), as applied to claims 1, 19, and 38 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. teach the following:

***regarding claims 15, 34, and 51,** a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 7, lines 42-44 of Silverbrook*), and a plurality of heater elements being disposed within each chamber (*col. 9, lines 20-23 with heaters 120, Figure 12 of Silverbrook*).

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. do not expressly teach the following:

***regarding claims 15, 34, and 51,** the heater elements within each chamber are formed on different respective layers to one another

***regarding claims 16, 35, and 52,** each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50

***regarding claims 18, 37, and 54,** each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless

Anagnostopoulos et al. teach the following:

***regarding claims 15, 34, and 51,** the heater elements within each chamber are formed on different respective layers to one another (*col. 8, lines 36-38*)

***regarding claims 16, 35, and 52,** each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54,** each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element formed of more than 90% Titanium into the invention of Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. The motivation for doing so, as taught by Chan (US 5870121), is to take advantage of TiN's highly stable and highly resistive characteristics (col. 5, lines 11-22).

Claim 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2), and Lee et al. (US 6460961 B2), as applied to claims 1, 19, and 38 above, and further in view of DeMoor et al.

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al., teach the following:

***regarding claims 17, 36, and 53**, each heater element is a solid material (*HfB_2; col. 28, lines 14-18*) and is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 9, lines 26-28*)

Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al., do not expressly teach the following:

***regarding claims 17, 36, and 53**, the heater element is less than 10 nanograms

DeMoor et al. teach the following:

***regarding claims 17, 36, and 53**, the heater element is less than 10 nanograms (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is* $4*10^{-12}$ *cm*^{3}*, and the volume of TiN within the heater is*

$2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook as modified by Gerber et al., Hiramatsu et al., and Lee et al. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Response to Arguments

Applicant's arguments with respect to claims 1-54 have been considered but are moot in view of the new ground(s) of rejection. Please see above rejection to Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), Hiramatsu et al. (US 6967312 B2), and Lee et al. (US 6460961 B2).

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vip Patel can be reached on (571) 272-2458. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SF 7/28/06

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